

# Vitreous Loss During Phacoemulsification Learning Curve Performed by Third-Year Residents

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**Objectives:** To assess the resident's phacoemulsification learning curve as a risk factor for vitreous loss and to determine the incidence of vitreous loss among the residents performing phacoemulsification.

**Design:** Retrospective matched case-control study

**Material and Method:** A case-control study comparing all consecutive cases of attempted phacoemulsification with intraocular lens (IOL) implantation from January 1<sup>st</sup>, 1998 to December 31<sup>st</sup>, 1999. The surgeon variable will be categorized into two groups, the third year ophthalmology residents, representing resident's phacoemulsification learning curve, and faculty staffs. The study group consisted of eyes that had had intraoperative complication of vitreous loss. The control group consisted of eyes that had not had vitreous loss. Continuous variables were compared with the 2-sided unpaired t-test. Categorical variables were compared between groups using analytical matched case-control study with relative risk or odd ratio, Mc Nemar's (Marginal)  $\chi^2$  test and 95% confident interval of relative risk.

**Results:** The odds that the eyes in the resident group would have an intraoperative complication of vitreous loss were 4 times the odds that the eyes in the faculty staff group would have such complication ( $P = 0.0052$ , 95% confidential interval (CI) of relative risk (RR) = 1.516-10.556). The incidence of vitreous loss among residents was 6.93% (28/404) and 2.06% (28/1358) among the faculty staffs. The overall incidence of vitreous loss was 3.18% (56/1762).

**Conclusion:** The incidence of intraoperative complication of vitreous loss, the relative risk of such complication performed by the learning curve surgeon in the present study serve as benchmarks for residents-in-training, beginning and surgeon-in-practice converting to phacoemulsification.

**Keywords:** Vitreous loss, Phacoemulsification learning curve, Resident

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Cataract surgery is one of the most commonly performed surgical procedures in the world. Phacoemulsification is now the method of choice for cataract surgery. A survey of American Society of Cataract and Refractive Surgery members showed that phacoemulsification is their preferred technique<sup>(1)</sup>. An increasing number of surgeons have adopted it as their routine method of cataract extraction, and many patients expect to have small incision surgery. Training competent cataract surgeons is thus an important goal of any ophthalmology residency program. Failure to master

the technique upon the completion of the residency program restricts the professional ability, and therefore, the competitiveness, of ophthalmology residents. It is vulnerable to periodically review outcomes of cataract surgery performed by residents to ensure high standards of patient care, provide feedback to the resident surgeons, and assure the faculty that resident surgical education has been adequate.

Vitreous loss can be a serious complication of cataract surgery. The rate of vitreous loss among residents performing planned extracapsular cataract extraction (ECCE) with expression of the nucleus has been reported to vary between 1 to 10%, depending on the surgeon's experience<sup>(2-5)</sup>. The incidence of vitreous loss

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for physicians learning phacoemulsification was reported by many researchers. With apparent growing popularity of phacoemulsification, it would be desirable to have more information regarding the incidence of vitreous loss among physicians learning this procedure.

Several reports have proposed a correlation between the physician's learning curve and increased incidence of vitreous loss during phacoemulsification. The incidence of vitreous loss in phacoemulsification performed by the residents has been reported between 1.8 to 10%<sup>(6-13)</sup>. However, these studies are limited by the absence of a control group. The investigators performed a matched case-control study to further assess the resident's phacoemulsification learning curve as a risk factor for vitreous loss during phacoemulsification and to determine an updated review of the incidence of vitreous loss among the residents performing planned phacoemulsification cataract surgery during the third year of their training.

#### Material and Method

The authors retrospectively reviewed the medical records of all consecutive cases of attempted phacoemulsification with intraocular lens (IOL) implantation performed at the Department of Ophthalmology, Chulalongkorn University and Hospital from January 1<sup>st</sup>, 1998 to December 31<sup>st</sup>, 1999. The authors excluded patients who had had cataract surgery combined with other procedures such as trabeculectomy, keratoplasty, or vitreoretinal surgery. If both eyes had vitreous loss, only the right eye will be enrolled.

Data abstracted from the medical record including demographics, date of phacoemulsification cataract surgery, surgeon, type of cataract and pre-operative visual acuity. The surgeon variable will be categorized into two groups, the third year ophthalmology residents, representing resident's phacoemulsification learning curve, and faculty staffs. Before performing phacoemulsification, each resident had performed 60 to 80 ECCE procedures as the primary surgeon. All phacoemulsification surgery performed by these residents were supervised by an attending surgeon using an assistant microscope.

An intraoperative complication of vitreous loss was defined as a discontinuation of the anterior vitreous face with the presence of vitreous gel in the capsular bag or anterior chamber at the time of surgery.

The study group consisted of eyes that had had intraoperative complication of vitreous loss during a routine phacoemulsification. The control group consisted of eyes that had not had intraoperative complication of vitreous loss during a routine phacoemulsification. The case-control pairs were matched as closely as possible for age, gender and date of surgery. The control that fit all of the matching criteria and was closest to the date of surgery in the case that was used.

#### Statistical analysis

Analysis consisted of three steps. First, all data were descriptively analyzed and their distributions in various study groups are presented. Second, continuous variables were compared with the 2-sided unpaired *t*-test. Third, categorical variables were compared between groups using analytical matched case-control study with relative risk or odd ratio, Mc Nemar's (Marginal)<sup>TM2</sup> test and 95% confidential interval of relative risk. A p-value of 0.05 was used as the threshold for statistical significance. Data analysis was performed using a commercially available statistical program (SPSS for Windows, release 10; SPSS Inc. Chicago, Ill, USA).

#### Results

A total of 100 eyes of 100 patients (50 cases and 50 controls) were included in the present study. The patient demographic and clinical characteristics were analyzed. There was no differences in mean age, age distribution, diagnosis of posterior subcapsular cataract, and preoperative best corrected visual acuity (BCVA) between the two groups.

Total number of reviewed eyes and the incidence of vitreous loss for each category of surgeons are shown in Table 1. A total of 1,762 eyes were reviewed in the present study. 404 eyes (23%) were operated on by residents, 1,358 eyes (77%) were operated on by the

**Table 1.** Total number of reviewed eyes and the incidence of vitreous loss for each category of surgeons

	N of total cases (%)	N of vitreous loss (%)	Incidence of vitreous loss (%)
3 <sup>rd</sup> year residents	404 (23)	28 (50)	6.93
Staffs	1,358 (77)	28 (50)	2.06
Over all Surgeons	1,762 (100)	56 (100)	3.18

faculty staff. The incidence of vitreous loss among residents was 6.93% (28/404) and 2.06% (28/1358) among the faculty staff. The overall incidence of vitreous loss was 3.18% (56/1762). The date of surgery was successfully matched to within 5 days in all case-control pairs.

The odds that the eyes in the resident group would have an intraoperative complication of vitreous loss were 4 times the odds that the eyes in the faculty staff group would have such a complication ( $P = 0.0052$ , 95% confidential interval (CI) of relative risk (RR) = 1.516-10.556).

## Discussion

Vitreous loss is one of the most serious intraoperative complication of cataract surgery. Its incidence ranges from 2.9% to 9.0% when ECCE was performed by residents but has been reported to be as high as 14.7% when residents performed phacoemulsification in the anterior chamber<sup>(13)</sup>. Phacofracture techniques in residency programs significantly reduce vitreous loss rates (1.8% to 10%)<sup>(9,14)</sup>.

The incidence of vitreous loss among senior surgeons converting to phacoemulsification is between 1.0 and 13.7%<sup>(6,7,15)</sup>. The third year residents in the US have vitreous loss of 3.1 to 14.7%<sup>(17)</sup>. Cruz et al<sup>(13,17,18)</sup> found a rate of 5.5% among third year residents learning curve. Registrars learning phacoemulsification in the UK have reported a vitreous loss rate of 3.8%<sup>(19)</sup>.

In the present study, the third year residents, the faculty staffs and overall group have the incidence of vitreous loss of 6.93%, 2.06% and 3.18% respectively. Regarding the complications, the presented rate of vitreous, 6.93%, is within the range reported by several other authors for phacoemulsification performed by residents.

The risk of intraoperative complication of vitreous loss during planned phacoemulsification performed by the residents (representing the learning curve) differs from such complications performed by the experienced faculty staff. Although numerous studies have documented the results of phacoemulsification surgery performed by residents or by the learning curve ophthalmologists but there has been no report of relative risk or odd ratio of these complications in the literatures.

The residents have a 4 times higher risk than the faculty staffs to induce intraoperative vitreous loss during routine phacoemulsification. The authors believe that the residents should be proficient in performing extracapsular cataract surgery with manual expression of the nucleus before learning phacoemul-

sification. Phacoemulsification on difficult cases should be reserved until the resident is quite comfortable with the procedure.

Vitreous loss rate may provide feedback for both residents and faculty regarding the adequacy of our cataract training program. Regarding complications, our rate of vitreous loss, 6.93%, the residency training has an acceptable rate of serious complications, compared to the previous reports. The authors believe that the present study demonstrates that acceptable rate of vitreous loss is attainable when teaching phacoemulsification in our residency training program. Close supervision by the faculty staffs at all times and their anticipation in the procedures as required was an important factor in keeping the complication rate at an acceptable level.

There are several limitations of the present study. As a retrospective analysis, the variables are limited.

It is difficult to say where a line should be drawn between cases that are suitable for resident surgery and those that are not, except that residents are not allowed to be the primary surgeon on functionally monocular patients.

The incidence of intraoperative complication of vitreous loss, the relative risk of such complication performed by the learning curve surgeon in the present study serve as benchmarks for residents-in-training, beginning and surgeon-in-practice converting to phacoemulsification. As teaching methods, instrumentation, and surgical techniques improve, the authors look forward to an even lower rate of complication in future comparable studies.

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## การสูญเสียวันตาระหว่างการผ่าตัดสลายต่อกระดูกโดยใช้ความถี่สูง ในระยะเรียนรู้ของแพทย์ประจำบ้านชั้นปีที่ 3

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**วัตถุประสงค์:** เพื่อประเมินความเสี่ยงและศึกษาเชิงเปรียบเทียบอุบัติการณ์ของการเกิดการสูญเสียวันตาระหว่างการผ่าตัดสลายต่อกระดูกโดยใช้ความถี่สูงในระยะเรียนรู้ของแพทย์ประจำบ้านชั้นปีที่ 3

**รูปแบบการศึกษา:** แบบย้อนหลัง, case-control แบบจับคู่

**วัสดุและวิธีการ:** ทำการศึกษา case-control แบบจับคู่ในผู้ป่วยที่ได้รับการผ่าตัดสลายต่อกระดูกโดยใช้ความถี่สูงและใส่เลนส์เทียมตั้งแต่วันที่ 1 มกราคม พ.ศ. 2541 ถึงวันที่ 31 ธันวาคม พ.ศ. 2542 โดยแบ่งเป็น 2 กลุ่มตามลักษณะของผู้ทำผ่าตัดคือ กลุ่มแพทย์ประจำบ้าน กับกลุ่มอาจารย์ กำหนดให้ผู้ป่วยที่เกิดการสูญเสียวันตาระหว่างการผ่าตัดเป็นกลุ่มศึกษา และไม่เกิดการสูญเสียวันตาเป็นกลุ่มควบคุม และเปรียบเทียบตัวแปรต่อเนื่อง โดยใช้การทดสอบ t แบบสองทาง ชนิดไม่จับคู่ ส่วนตัวแปรไม่ต่อเนื่องระหว่างกลุ่มวิเคราะห์โดยใช้ relative risk หรือ odds ratio โดยการทดสอบของ Mc Nemar ที่ระดับความเชื่อมั่น 95%

**ผลการศึกษา:** การเกิดการสูญเสียวันตาระหว่างการผ่าตัดสลายต่อกระดูกโดยใช้ความถี่สูงในระยะเรียนรู้ของแพทย์ประจำบ้านชั้นปีที่ 3 มีความเสี่ยงเป็น 4 เท่า เมื่อเทียบกับการผ่าตัดที่ทำโดยอาจารย์ ( $P = 0.0052$ , ระดับความเชื่อมั่น 95% = 1.516-10.556) กลุ่มแพทย์ประจำบ้าน กลุ่มอาจารย์ และรวมทั้ง 2 กลุ่มมีอุบัติการณ์ของการสูญเสียวันตา 6.93% (28/404) 2.06% (28/1358) และ 3.18% (56/1762) ตามลำดับ

**สรุป:** อุบัติการณ์ของการเกิดภาวะแทรกซ้อนสูญเสียวันตาขณะผ่าตัด ความเสี่ยงที่จะเกิดภาวะแทรกซ้อนนี้ในกลุ่มแพทย์ประจำบ้านที่ได้จากการศึกษานี้อาจนำมาใช้เป็นดัชนีชี้วัดเพื่อประเมินและพัฒนาการผ่าตัดสลายต่อกระดูกโดยใช้ความถี่สูงในระยะเรียนรู้ให้มีความปลอดภัยมากยิ่งขึ้นได้

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